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AUTHOR Buckholdt, David; And Others

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ABSTRACT

A positive reinforcement system was designed to see if reinforcement procedures, proven effective in modifying a wide range of disruptive classroom behaviors, would be effective for children who are not particularly disruptive but who work so slowly and ponderously that they fail to make satisfactory academic progress. Subjects were five such slow learners, ages 7-9 years, who, because of measured IQs of 65-80, were in a special remedial class. Reading, using the Sullivan Programed Reading Series, was selected as the remedial experimental task. An ABAB reversal design was used to test effectiveness of reinforcement system in accelerating rate of working in the readers, defined as number of correct responses per day. In A or baseline conditions, students worked on programed reading frames without extrinsic reinforcement, while in B conditions individual reinforcement contingencies were set (points exchangeable for store items). It was found that number of correct responses per daily 20-minute period was accelerated over baseline while accuracy remained high in condition B. When performance contingencies were withdrawn, performance deteriorated, but recovered when contingencies were reinstated. (KW)

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Effect of Contingent Reinforcement on Reading Performance with Primary Special Education Children

by

David Buckholdt, Harriet Doss Willis, Daniel Ferritor, Robert L. Hamblin

Recent behavior modification studies with children have shown that reinforcement procedures can be successfully used to modify a wide range of disruptive classroom behaviors. Inattention (Hall, Lund, and Jackson, 1968), aggression (Hamblin and Buckholdt, 1968), and disruption (Thomas, Becker, and Armstrong, 1968; Hamblin, Buckholdt, Ferritor, Kozloff, and Blackwell, 1971), can be reduced or even eliminated if unintended reinforcement for these disfunctional child behaviors is terminated, and concurrently, alternative reinforcement is provided for more functional school behaviors such as cooperation, attention, and following directions. Unfortunately, however, tested reinforcement procedures are not as readily available in the behavior modification literature for classroom problems which are not primarily disruptive in nature (Hanley, 1970). Yet, reinforcement procedures should, theoretically be useful for a variety of other school problems. For example, for children who are not particularly disruptive but who, nevertheless, work so slowly and ponderously that they fail to make satisfactory progress in school.

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Subjects

The authors were handed the opportunity to look at the problem of the slow worker when a special education teacher from an inner-city school in St. Louis, Missouri, asked for help in designing a reinforcement system for five of her children who worked, in her judgment, at an extremely slow pace and who were not making academic progress. At that time, the authors were running several studies elsewhere in the school using positive reinforcement and this teacher asked if similar procedures might be used to help some of her children.

The five children who participated in this study were from an inner-city school in an impoverished area of St. Louis, Missouri. Their ages ranged from 7 to 9 years and their I.Q. scores, as tested by the school, ranged from 65 to 80. All five of the children were members of a special remedial class, having been assigned there on the basis of their low I. Q. scores and their inability to pass beginning first grade primer tests. None of them had ever been given a standardized achievement test because the teacher claimed that their academic skills had not developed beyond a beginning first grade level, even though they had all been enrolled in public school for at least one and a half years. Their classroom work was slow, sloppy, and inaccurate, according to the teacher, but none of the children were particularly aggressive or otherwise disruptive.

Method

The authors' first thought was to try standard reinforcement contingencies for "cooperative," "on-task," and "direction following" behavior since several recent studies have suggested that work skills and academic achievement will be indirectly increased when such functional classroom behaviors are reinforced (O'Leary, Becker, Evans, and Saudargas, 1969; Schmidt and Ulrich, 1969; Surratt, Ulrich, and Hawkins, 1969), and when disruptive behaviors are reduced. This strategy was eventually rejected for two reasons, however:

1. The problems these children displayed did not appear to be primarily "behavioral" in the sense of excess aggression, activity, or withdrawal.

2. Several recent studies show that an increase in academic performance is not an inevitable or natural by-product of behavioral reinforcement (Quay, 1969 ; Ferritor, Buckholdt, Hamblin, and Smith, 1971; Wodarski, Hamblin, Bukcholdt, and Ferritor, 1971).

The authors decided then to design a procedure which would reinforce, and thus increase academic performance directly without relying on a doubtful transfer from behavioral reinforcement.

Reading was chosen as the remedial experimental task for the children at their teacher's request since this was the subject in which they were most deficient and the skill which was probably most important for their future success in school.

The Sullivan Programmed Reading Series[1] was selected because the beginning books in the series were elementary enough for the children, were individualized to allow each child to procede at his own pace, were programmed, and were highly attractive to the children. The five children first worked in Supplementary Book 1A[2] for several days under no experimental constraints until they were familiar with the format of the book, the several types of questions asked, and the procedure for working independently and continuously.

The procedure recommended by the publisher for working in the readers calls for the children to read a passage (sometimes only one sentence in length), answer a "true or false" or "fill in the blank" question, move a slider down on the left of the page to check the accuracy of the answer, and then to move on if the answer was correct or to re-do the question if the answer

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[1]Cynthia Dee Buchanan, Sullivan Associates, Programmed Reading, McGraw-Hill Book Co., St. Louis, Missouri. This reading series consists of 21 books, each 144 pages in length, ranging in difficulty from beginning first through third grade. Books 1 to 4 were used in this study. In each of these books, the pages generally contain 3 to 4 "frames" which relate to an adjacent picture. Each frame consists of several questions. The questions are of the "yes-no," "choose the correct answer," or "fill in the blank," variety. Each child has his own set of books in which he answers the questions by filling in letters or circling the correct answer. The introduction of the new vocabulary words is gradual and well planned and the books appear to be similar in degree of difficulty, assuming of course, the mastery of prior material.

[2]Book 1A is a simplified version of Book 1 and is generally used either as a remedial exercise after a child has failed to meet a criterion score in Book 1 or it can be used as an introduction to Book 1.

was incorrect. These children, however, could not resist looking at the answer before they responded. Generally, during the initial practice sessions, they would look at the answer and then complete the question without ever reading the passage or the related question. Since we could not stop this "cheating," we decided to cover the answers in Book 1 and succeeding books with tape and thus make cheating impossible, even though we lost the potential value of immediate feedback.

The revised procedures the children followed each day were then as follows:

1. The children would arrive at 10:15 a.m. and receive their books which were marked to show where they had started on the previous day. If they had finished the book, they would receive the next book in the series.

2. The work of the previous day had been marked and errors were noted and corrected in red. The children were asked to review their errors and to inquire about them if they did not understand them.

3. At about 10:30 a.m., when all the children had completed a review of their previous day's errors, they would begin working in the readers from the end point of the previous day and would work independently for 20 minutes. The teacher did not interact with the children during this time.

4. At the end of the 20 minutes, the children would quit working. If they desired, they could then ask questions about the day's work. The books were then collected and the responses were graded and corrected before the children arrived on the following day.

At the beginning of each session, the teacher reminded the children to "work hard," "pay attention to what you are reading," and "don't bother others." No further advice, warnings, or help

was given during the 20 minute period. Occasionally, the teacher answered a question unrelated to the reading, but she generally sat at a desk and read without further interacting with the children.

An ABAB reversal design was used to test the effectiveness of the reinforcement system which was developed to accelerate the children's rate of working in the Sullivan Readers. Rate was defined as number of correct responses per day.

In the A or baseline conditions, the children worked on the programmed reading frames without the benefit of any extrinsic reinforcement. In the B conditions, individual reinforcement contingencies were set for each child. These contingencies were first established by locating for each child the five days in the first A period in which the fewest correct responses were made. These five lowest scores were then averaged to create a "minimum score" below which a child could not receive reinforcement. Five points were awarded daily to each child who equaled his minimum score and one point in addition was given for each correct response beyond the minimum. As the children showed that they could consistently score well above the minimum level, the minimum level was increased. Table 1 shows the original minimum scores and the day and amount of the changes in the B conditions. Points were awarded at the beginning of each experimental session based on the previous day's work and were exchanged for desirable store items each Friday. The children could purchase snacks, beverages, games, toys, books, and occasionally a field trip with their points.

Results

At the beginning of the first A period (A_1), the children appeared to be delighted to leave their room each morning and to work in the Sullivan Readers. They were cooperative and attentive while they worked individually on the programmed reading materials and they accomplished a considerable amount of work in the first four days of period A_1 - a median of over 90 correct responses per day in 20 minutes at close to 90 percent accuracy, as shown in Figure 1. By the fifth day, however, their performance began to decrease. There was no noticable increase in disruptiveness or decrease in attention, yet the median number of correct responses per day began to decline, eventually reaching a near low of 46 correct responses on the final day of A_1. Accuracy remained high (circa 90 percent) during this period, but the children seemed to loose some of their original interest and motivation as indicated by their decreased median rate of correct responses per day. With the possible exception of Ben, each child showed the same general downward trend in correct responses per day as did the median trend. (See Figures 2 through 6.) Rose (Figure 4) and Mary (Figure 2) showed some tendency to fall below the median percentage for accuracy, but in general, accuracy remained around 90 percent.

With the introduction of the reinforcement system in the first B period (B_1), number of correct responses showed a gradual, sometimes variable, yet generally consistent median increase,

stabilizing at about 75 median responses per day at the end of the sixteen day period. This median increase in number of correct responses worked per day was also evident in the performance of each individual during B_1 as well. The median percentage of correct responses remained at about 90 percent. Except for A.J., whose accuracy was slightly more variable (Figure 3), individual percentages did not suffer. In fact, Rose (Figure 4) and Ben (Figure 6) appear to have become somewhat more accurate.

With the termination of reinforcement in the second A condition (A_2), the number of correct responses fell dramatically after three days. By the end of the 6 day period, the children had reached a new median low of 21 correct responses. A similar downward trend is evident also in each individual graph. Median and individual percentages, however, remained around 90 percent, until the final day of A_2 when they dropped considerably.

This downward trend in A_2 was successfully reversed in the second B condition (B_2), with the reintroduction of the reinforcement procedures. Median number of correct responses jumped immediately to 86 and 82 for the two day period while the median percentage correct recovered to around 90 percent. The individual records also show a similar increase on both measures from the downward plunging performance data of B_2.

Unfortunately, the experiment had to be terminated two days into period B_2. Several interruptions caused by testing and field trips in the special classes, followed by the lengthy absence

of several of the children due to illness, prevented us from continuing.

Summary and Implications

Number of correct responses per day in the Sullivan Programmed Readers was accelerated over baseline while accuracy of work remained high for five primary age, inner-city, special education children when positive reinforcement contingencies were applied directly for the number of correct responses each child completed daily in a 20 minute period. Performance deteriorated when the individually set performance contingencies were withdrawn but quickly recovered when the contingencies were reinstated.

The deteriorating reading performance of periods A_1 and A_2 shown in Figure 1 for the five children in this experiment is perhaps indicative of the academic development of many inner-city children in "special" classrooms. Often, their study habits and motivation appear to grow weaker over time and they fall ever further behind in critical school skills. Several remedial procedures are generally recommended either individually or in combination, with such children. Drug therapy is tried with some who are overly active. Better curriculums are offered which provide a child with more relevant, more interesting, and more individualized material. The teachers are better trained to recognize individual problems, to work with parents, and to plan individualized remedial programs. Smaller classes and more teachers per pupil may help the child who is not learning. Reinforcement programs are initiated which build functional classroom

behaviors and reduce the disfunctional behaviors which often interfere with learning. Finally, achievement motivation and related approaches are sometimes used to strengthen the child's self-concept and his desires and expectations for success.

One of the long-range goals of each of these remedial approaches is to increase academic performance and skill. Unfortunately, current evaluative data does not allow us to assess either the absolute or relative effectiveness of any of these approaches in meeting this goal. It does appear, however, that reinforcement procedures can be used to increase performance. The data does not tell us that performance reinforcement is more or less effective than any alternative approach, but they do appear to show that an increase is obtained when performance is reinforced directly. One way to structure performance reinforcement is by means of contingencies based on individually set minimum expectations. Current performance levels would be individually determined and positive contingencies could then be set for performance at a minimum level and "bonuses" could be offered for performance above the minimum. As the children improve, with practice and time their minimum expectation levels could be periodically revised upwards as the quality and quantity of their work steadily improves or revised downwards if the tasks suddenly become significantly more difficult or if an uncontrollable event (e.g., parents separate) hinders the child's ability to work.

An individually prescribed performance reinforcement system would probably have a maximum benefit with young children in special education where the numbers are generally small and the motivation is unusually low. There is at least one potentially serious problem which needs to be further investigated, however, before such a remedial procedure could be recommended without reservation-the problem of "reinforcement addiction." As can be seen in condition A_2 of Figure 1, once reinforcement was removed in this study, performance declined significantly below the base rate which obtained before reinforcement was introduced. This trend may have been reversed with time, but we cannot be certain. It certainly is not a typical result in reinforcement studies on disruption and aggression. Children eventually may not be able to work even at their pre-experimental level without extrinsic reinforcement. The problem is only potential and not inevitable, however, even if it is real. If extrinsic reinforcement is phased-out gradually on a well-planned, more and more delayed intermittent schedule, the "addiction problem" will probably not occur. However, if reinforcement is changed or terminated too quickly or haphazardly, the children could easily be damaged.

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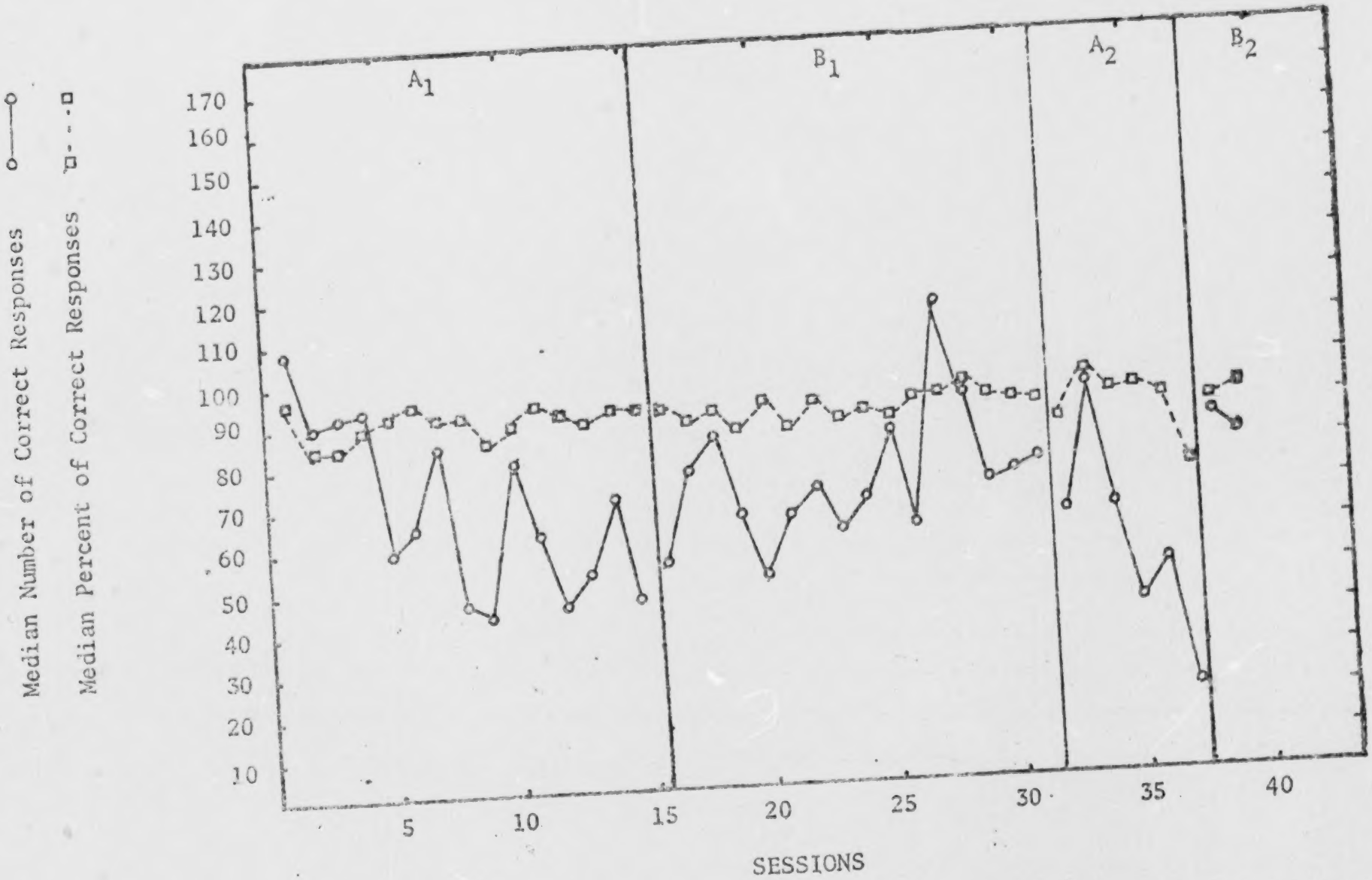

Figure 1. Median number of reading responses worked correctly and median percent worked correctly for five inner-city, special education children working in the Sullivan Programmed Readers, beginning with Book 1. In the A Conditions, the children worked without the benefit of reinforcement. In the B Conditions, points were given daily to children who equaled an individually set minimum performance expectation of number of correct responses per day. Bonus points were given for performance above minimum. Points were exchanged weekly for desirable material or activity reinforcers. Minimum expectation levels were changed periodically as the children's performance improved.

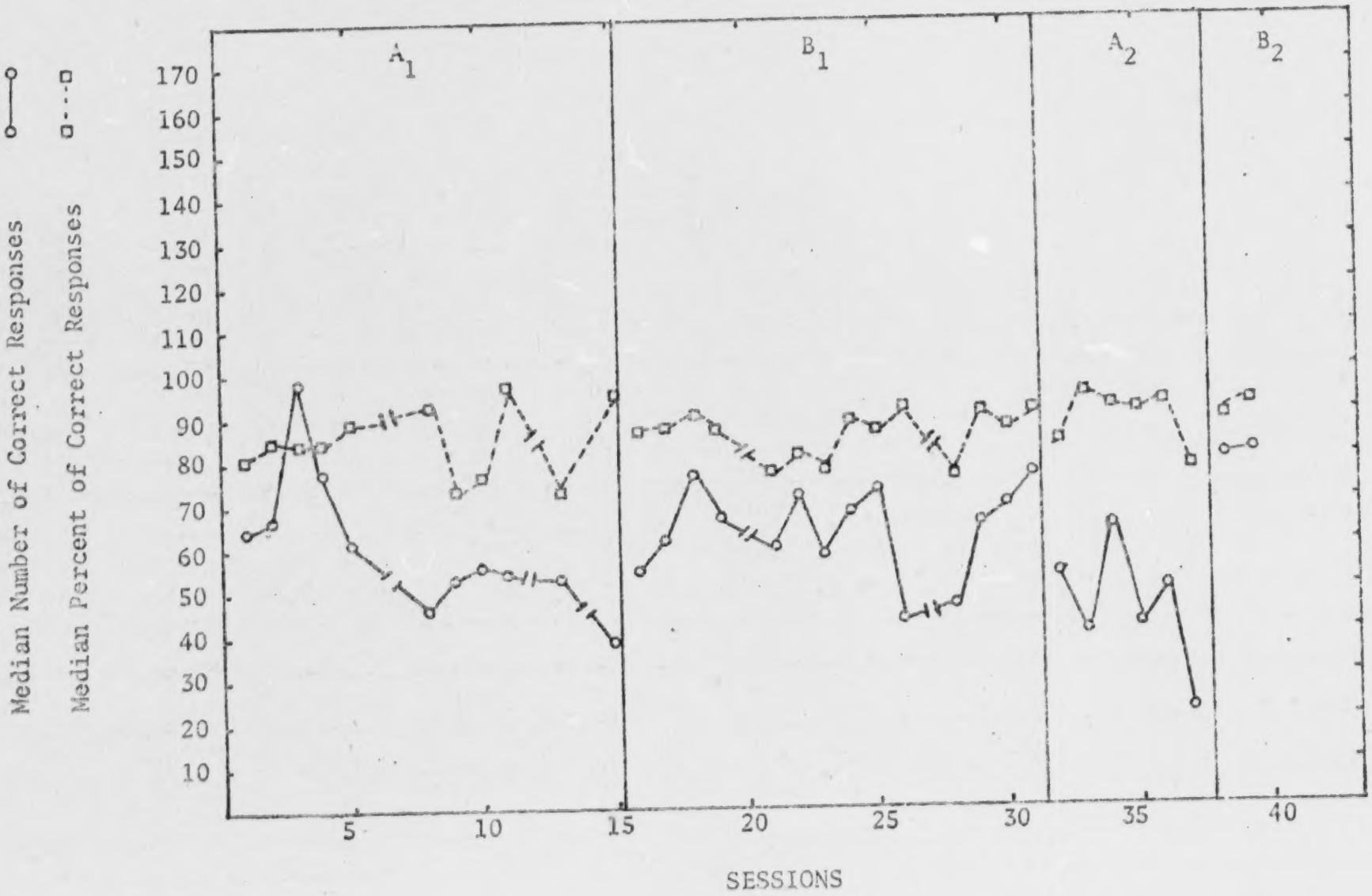

Figure 2. Mary — Number of reading responses worked correctly and median percent worked correctly for Mary in the Sullivan Programmed Readers, beginning with Book 1. In the A Conditions, Mary worked without the benefit of reinforcement. In the B Conditions, she received points on the days when she equaled a minimum performance level which was individually set for her on number of correct responses per day. A bonus was given when she exceeded this minimum. Mary exchanged her points weekly for desirable material or activity reinforcers in the B Conditions. Her minimum level was changed periodically as her reading performance improved.

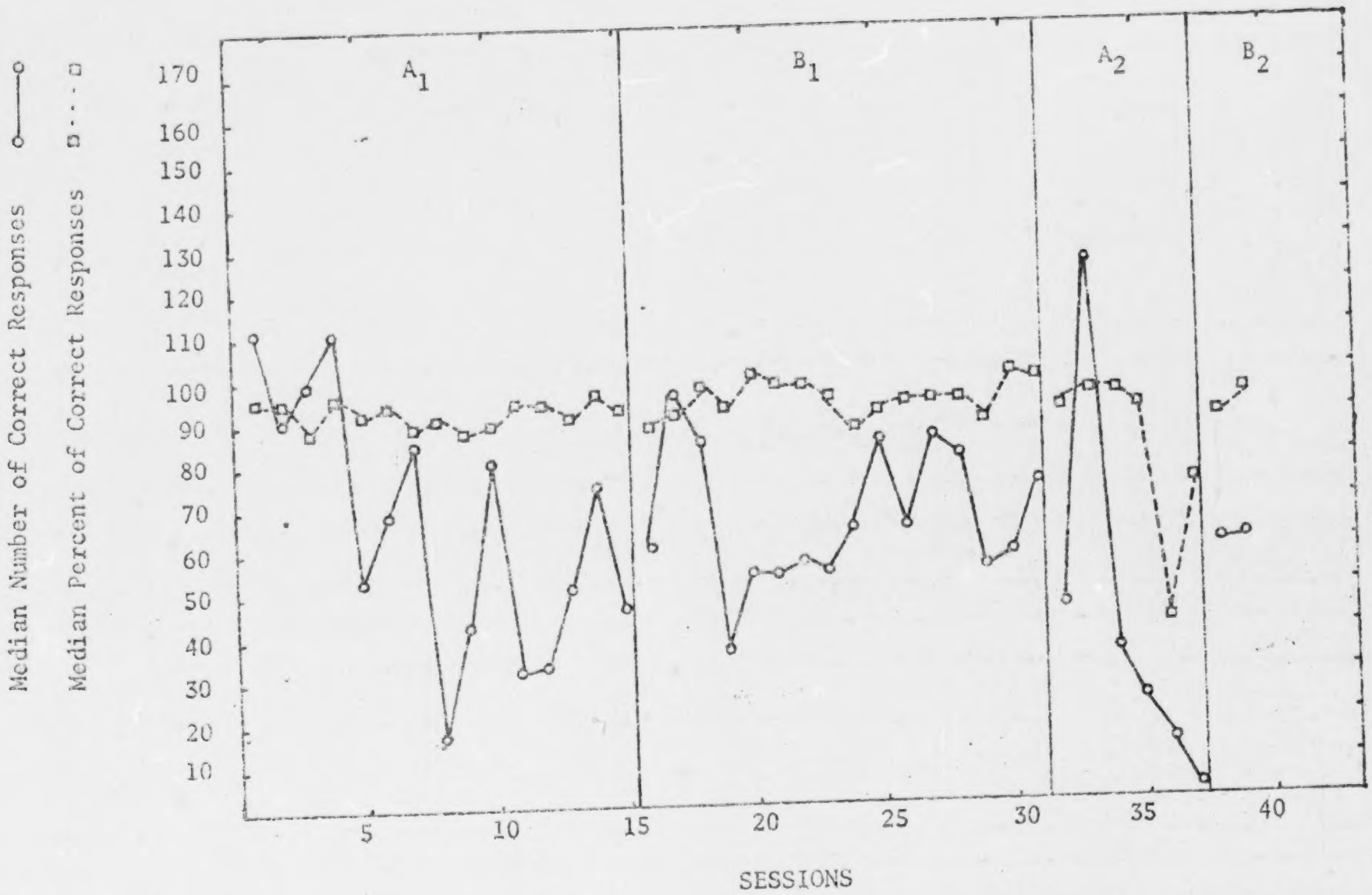

Figure 3. Number of reading responses worked correctly and median percent worked correctly for A.J. in the Sullivan Programmed Readers, beginning with Book 1. In the A Conditions, A. J. worked without the benefit of reinforcement. In the B Conditions, he received points on the days when he equaled a minimum performance level which was individually set for him on number of correct responses per day. A bonus was given when he exceeded this minimum. A. J. exchanged his points weekly for desirable material or activity reinforcers in the B Conditions. His minimum level was changed periodically as his reading performance improved.
A.J.

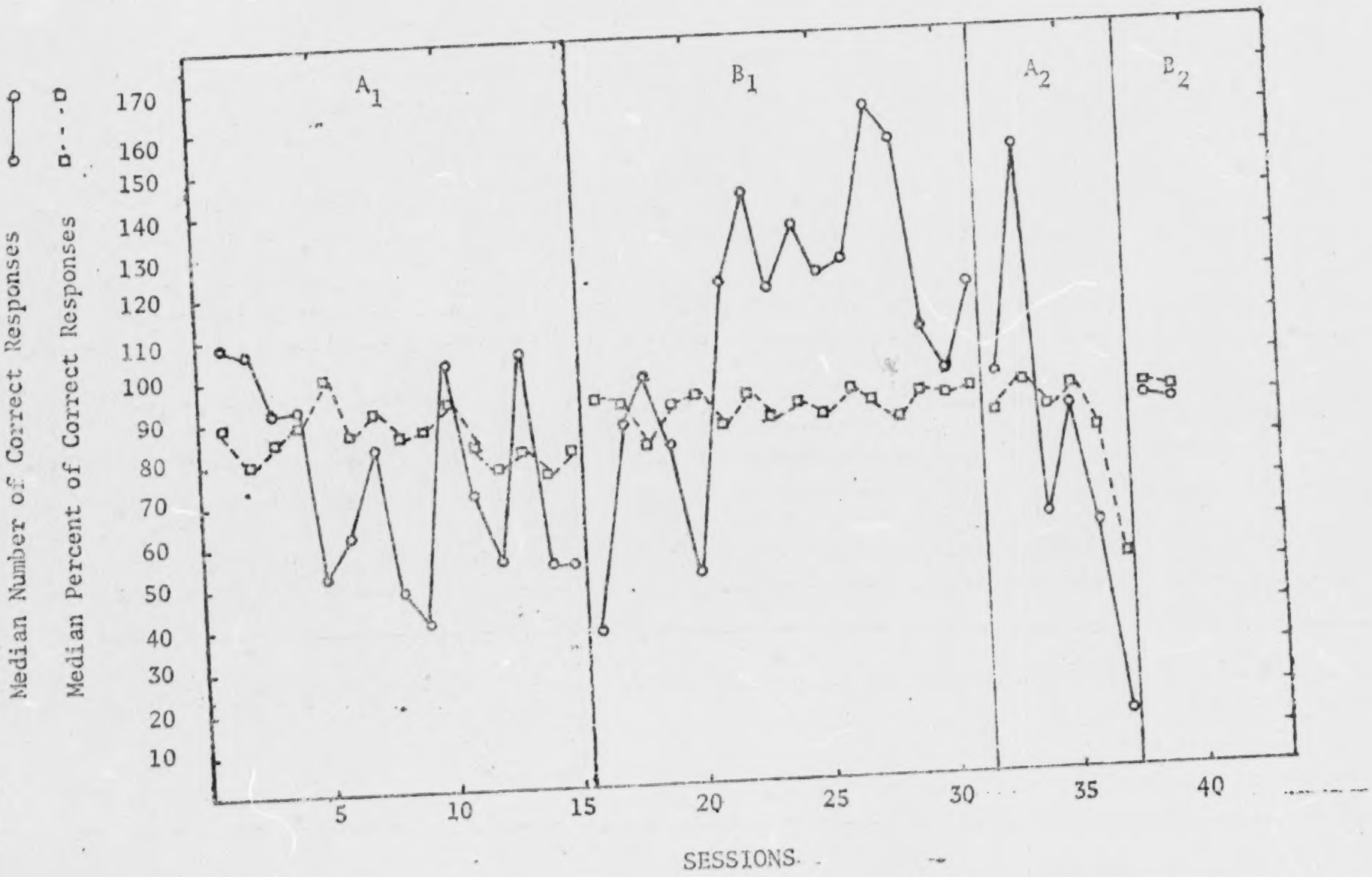

Figure 4. Number of reading responses worked correctly and median percent worked correctly for Rose in the Sullivan Programmed Readers, beginning with Book 1. In the A Conditions, Rose worked without the benefit of reinforcement. In the B Conditions, she received points on the days when she equaled a minimum performance level which was individually set for her on number of correct responses per day. A bonus was given when she exceeded this minimum. Rose exchanged her points weekly for desirable material or activity reinforcers in the B Conditions. Her minimum level was changed periodically as her reading performance improved.

Rose

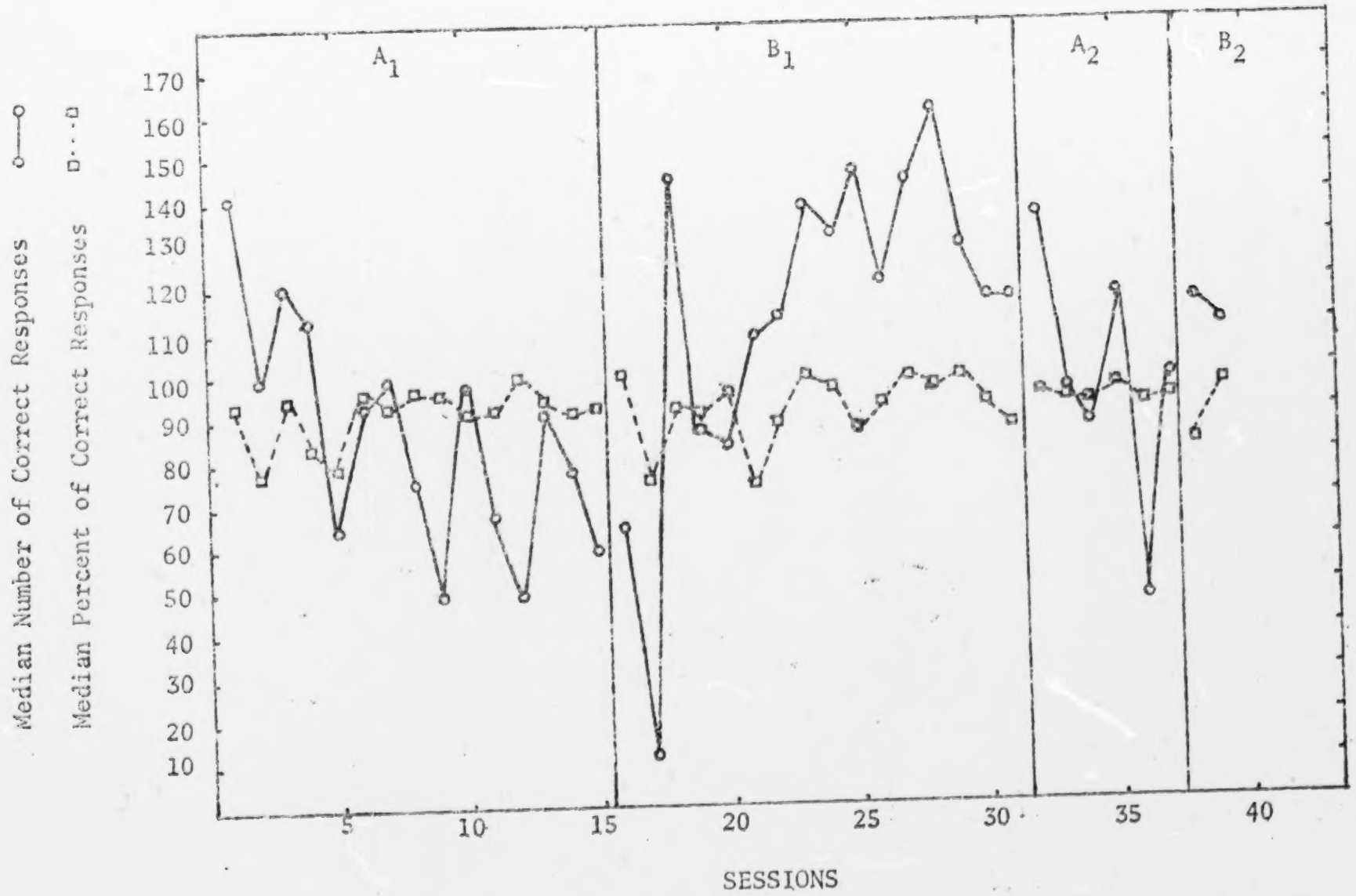

Figure 5. Sharon

Number of reading responses worked correctly and median percent worked correctly for Sharon in the Sullivan Programmed Readers, beginning with Book 1. In the A Conditions, she worked without the benefit of reinforcement. In the B Conditions, she received points on the days when she equaled a minimum performance level which was individually set for her on number of correct responses per day. A bonus was given when she exceeded this minimum. Sharon exchanged her points weekly for desirable material or activity reinforcers in the B Conditions. Her minimum level was changed periodically as her reading performance improved.

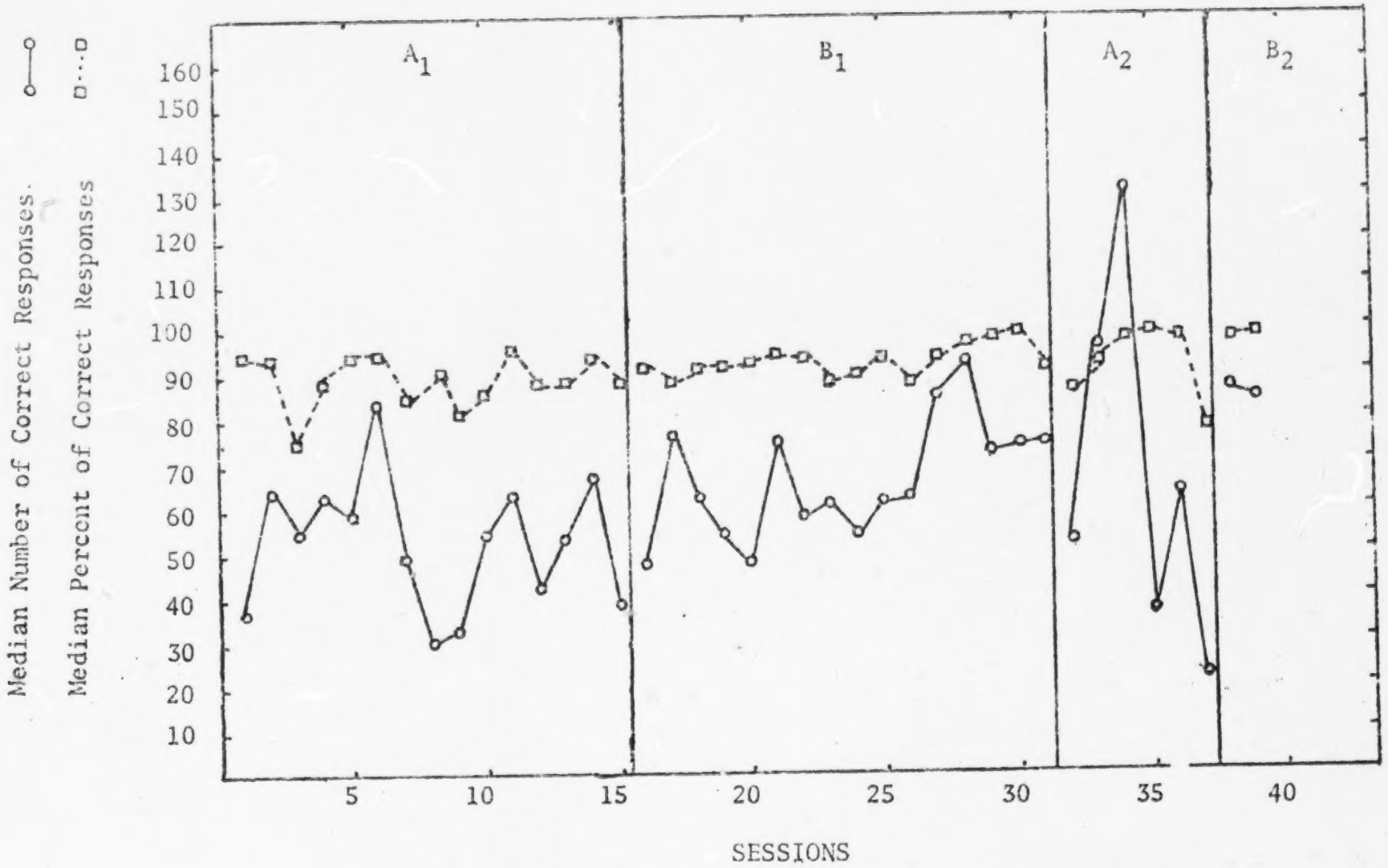

Figure 6. Ben — Number of reading responses worked correctly and median percent worked correctly for Ben in the Sullivan Programmed Readers, beginning with Book 1. In the A Conditions, he worked without the benefit of reinforcement. In the B Conditions, he received points on the days when he equaled a minimum performance level which was individually set for him on number of correct responses per day. A bonus was given when he exceeded this minimum. Ben exchanged his points weekly for desirable material or activity reinforcers in the B Conditions. His minimum level was changed periodically as his reading performance improved.

Table 1. Minimum Number of Correct Responses Required To Earn Reinforcement

	Minimum Score				
Condition-Session	B1-16	B1-20	B1-26	B1-30	B2-38
Mary	46	56	66	66	56
A. J.	52	67	85	115	67
Rose	47	57	85	95	57
Sharon	30	40	45	55	40
Ben	33	43	45	80	43